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ABSTRACT

This paper addresses the importance of assessing and realizing students' needs and expectations while developing a virtual learning environment (VLE). The project Virtual OR/MS is funded by the Federal Ministry of Education and Research of the German Government. It involves seven German partners from six universities. The goal of the project supports the four trends as judged by Longworth to be essential in managing the challenges of the 21st century: increased use of educational tools and techniques; greater use of national and international networks; development of co-operative and two-way partnerships; and development of learning organizations and individual empowerment. The evaluation methods, their results, and the conclusions made for the development of the VLE are the focus of this paper. (Contains 16 references.) (AEF)

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Meeting Students Expectations and Realizing Pedagogical Goals within the Development of a Virtual Learning Environment

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Abstract

This paper addresses the importance of assessing and realizing student's needs and expectations while developing a virtual learning environment (VLE). Realizing student's needs in the development of the VLE is one of our key interests out of the pedagogical perspective in the project "Virtual OR/MS" (Vorms). Only if we involve our target group in the design and development process of the learning environment we can ensure that they are going to be satisfied with the product we are developing for them. The thoughtfully defined target group is the basis for developing effective evaluation forms. This paper describes the results of the combination of qualitative and quantitative empirical research and evaluation.

1 Introduction

The project Virtual OR/MS is funded by the BMBF (Federal Ministry of Education and Research) of the German Government. It involves seven German partners from six Universities. The goal of the project supports the four trends as judged by Longworth to be essential in managing the challenges of the 21st century:

1. increased use of educational tools and techniques,
2. greater use of national and international networks,
3. development of co-operative and two-way partnerships, as well as
4. development of learning organizations and individual empowerment

(Longworth 1996).

The close cooperation with the project OR-World (Kassanke 2000, Kassanke 2001), funded by the European Community, enables us to build upon an already existing technological framework. The learning and teaching environment created in OR-World is non-linear and multidimensional allowing cost-effective creation and sharing of materials as well as a personalized mix of contents. Vorms focuses on content generation. Students will be able to visit courses which are based on joint hypermedia environments or explore the hyperspace in a self-study process. Looking upon these goals from a pedagogical point of view, it is very important to design a didactical concept. This concept will integrate the expectations of the target group where possible.
To meet student's expectations in a VLE it is essential to know as much as possible about the target group. In a first step of the realization of our pedagogical goals this was done by the team members of the Vorms project. After outlining for whom the VLE is being developed, the expectations of these persons were evaluated. This was done by conducting a combination of qualitative research, realized as group discussions, and quantitative research, in form of a questionnaire. The evaluation methods, their results, and the conclusions we made for the development of our VLE are the focus of this paper.

2 Target Group

Defining the target group is an essential step in the development of a learning environment (see Euler 1992, p. 85). For the time being Vorms focuses on University students, who specialize in Operations Research (OR). In the future, Vorms also wants to address company employees, who want to extend

their knowledge about OR. These two target groups are very homogeneous considering the relevant characteristics for the learning environment, thus it is possible to widen the scope of the target group for the future.
Learners who are interested in the subject OR and have a business background are the target group for Vorms. Their situative, affective and cognitive dispositions can be characterized as follows:

Situative disposition

- Computer-familiarity is rated between high and very high.
- Content-familiarity is rated as low.

Affective disposition

- The acceptance of computer aided instruction is rated as high.
- Learning demands are factual.
- Feedback in the learning process is received as objective, not as personnel feedback.

Cognitive disposition

- An active, intrinsically motivated learning style is assumed.
- The subjective perception is the favorable perceptive faculty.
- Abilities of processing new information are rated as high.

3 Evaluating students expectations

The systematic evaluation was divided into two parts (see Stufflebeam 1985, p. 176; Falk 1995, p. 123). In the first part qualitative, empirical research was done to collect qualitative data. In the second part, the results of the qualitative data were validated, by transferring them into a questionnaire, a quantitative research method, to determine the distribution of the expectations.

3.1 Group Discussion

The group discussion is a qualitative, empirical method and is used to give the interviewees freedom to state what they think, without pressing them into predefined categories (see Kromrey 1998, p. 267; Flick 1996, p. 10). Approximately 120 students were interviewed in groups of about 10 students per group. Techniques such as free associating (see Schnell 1988, p. 391) were used to identify topics of importance to the learners, and other techniques such as focusing (see Koenig 1999, p. 149) were used to explain these topics. After identifying and defining topics of importance, additional key questions were asked, to make out further topics of interest. The results of the group discussion were rated systematically in form of a category system (see Koenig 1999, p.162).

Results of the group discussion
Students expectations regarding VLEs can be grouped into the following categories:

- Installation
- User-orientation / Navigation
- Software-ergonomics
- Content
- Learning Assessment
- Help Functions
- Examples
- Internet Functions.

Installation
If installation is necessary, students expect installation and de-installation to be fast and complete, leaving no debris after de-installation. Students want to be able to decide the installation path themselves, they do not want it to be a default setting. There should be more than one installation version of the program, i.e. a customized version for laptops is rated as important.

User-orientation / Navigation
The main expectation in the category of user-orientation is that the learning environment meets common standards. Students want the navigation to be easy and intuitive to use. Students want to be able to navigate freely to explore the learning environment, as well as being able to use guided tours. They want the possibility to activate a guide, that shows them how the program works. Pages that have been opened before should be marked visited, with the option to clear the mark manually. Many students declare, that they want to be able to use bookmarks, make their own comments on pages or use highlighting pens.

Software-ergonomics
Few students come up with this topic on their own. Once asked by the interviewer many students stated, that the learning environment has to have good software-ergonomics. After inquiring further, the students were not able to describe what they meant with "good", mostly they said they couldn't describe it, they would need to have an example and then they would be able to say this product has good or poor software-ergonomics.

Content
Students expect a VLE to give an overview of all topics covered in the corresponding lecture. Contents of the lecture and the learning environment should be synchronized. One idea to realize this is to offer a guided tour, which is built up in the same structure as the lecture is. The electronic version should extend the contents of the lecture, so if the student is interested in a certain topic, he can get more information to this topic from the learning environment, and he does not have to search in any other information resources. Some students want the VLE to offer complete exam preparation. Several students wanted the VLE to offer different access possibilities to explanations. For example they imagined choosing either textual or mathematical explanations for the exercises. Most students requested the VLE to estimate the time needed to complete a learning sequence.

Learning Assessment
Some kind of learning assessment is requested by almost every learner. Students want the VLE to supply plenty of questions so they can practice very much, not having to repeat the same examples over and over again. They want to choose exercises from a pool of questions with varying difficulty levels. Some students want to choose the difficulty level themselves. Others would prefer for the VLE to keep track of how good they are and ask the next questions according to their skill level. These students would like the VLE to decide in which area they have trouble answering questions correctly, and then ask them questions to these subjects. Several students state that they want some kind of reward for questions they answered correctly. This should not be too time consuming however. Several students proposed integrating a function, which simulates tests. Miscellaneously picking out questions and giving the students only a certain time to answer them – similar to doing a test in class. They are also keen on integrating tests, including their answers, out of the previous semesters into the VLE. It was also proposed to integrate a feature for sending questions to a tutor via email and getting personnel feedback.

Help Functions
Helping functions such as an abbreviation dictionary, an online help, a search function, an English dictionary, a glossary, and an overview of all used symbols are asked for.

Examples
Students want the VLE to offer many examples. They should not only be theoretical ones, but also ones out of real practice. Transfers of theory problems to real life problems should be made. Simulations and animations are also requested by the students to illustrate problems. The speed of animations should be individually settable and an animation must be stoppable at any time. It seems very important to the students to integrate all examples used in the lecture.

Internet Functions
An internet-based learning environment would be favored by some students to enable group work und update functionalities. They would like to be able to learn from anywhere at anytime. Some students

proposed implementing discussion databases, but even though they wanted them, they were not sure, if they would use them regularly.

3.2 Questionnaire

The second part of the evaluation uses the questionnaire method to validate the quantitative data collected in the first part. The questionnaire was developed according to the results of the group discussion. The questionnaire was answered by 58 students. 42 male students and 16 female students. This relation of male to female students represents the target group. The gender differences will be pointed out in the evaluation of the questionnaire.

Results of the questionnaire

The results of the questionnaire will be presented in the two categories: Work Independently and Self Assessment. The categories of the group discussion can be divided into two major categories. These are shown below in table 1.

Work Independently	Self Assessment
• Installation	• Learning Control
• User-Orientation / Navigation	• Help Functions
• Software-ergonomics	• Examples
• Content	• Feedback
• Internet functions	

Table 1: Categories of the Group Discussion

Work Independently

69% of the men and 50% of the women want to choose between different installation types. They want to have the possibility to install only parts of the program, for example a laptop version. 67% of the men and 81% of the women want some kind of explanation of how to use the program.

Students want to customize their learning material. They want to use bookmark functionalities and virtual highlighting pens. 52% of the men, and 88% of the women consider it important to post their own comments on a page. 94% of the women, and 88% of the men want to be able to use bookmarks. 93% of the men and 88% of the women want pages they have visited to be marked. A highlighting pen is requested almost equally by 69% of the women, and 62% of the men. 60% of the men and 50% of the women find it necessary to be able to customize their learning material by exporting parts into different programs (for example Power Point).

Students want to be able to use the VLE intuitively. They do not want to spend very much time to get used to the navigation. 88% of the men, and 50% of the women want the layout of the VLE to comply with common standards (for example Windows).

The majority of the students want learning sequences to be between 30-45 minutes. 44% of the women want the VLE to be server-based to enable working in groups. Only 24% of the men find this important. On the contrary, when asking if they want group work, 43% of the men said they did not want to VLE to support group work. Only 12% of the women wanted the VLE not to support group work. 67% of the men want the VLE to be accessible over the internet, 50% of the women thought so, too.

Self Assessment

Students prefer "pull-information" rather than "push information". They want to decide what they want to learn and when they learn it. 67% of the men, and 63% of the women want to be able to choose if explanations to questions are based either on text or on mathematical formulas. 83% of the men and 100% of the women want to choose exercises varying in difficulty levels i.e. beginner, advance and expert. 62% of the women and only 31% of the men want praise from the VLE if they answer a question correctly.

On the one hand students would like to use the VLE on their own, without being dependent on a teacher, but on the other hand, they want the VLE to try to simulate a classroom atmosphere. If the student does not understand an explanation in class he can ask the teacher to explain it in different

words, and that's what 88% of the women and 76% of the male students are now asking from the VLE. They would like the VLE to have more than one formulation as an explanation to a problem. Getting personnel feedback is important to the majority of the students. 69% of the men and the women want to be able to send exercises to a personnel tutor who corrects these and then gives them feedback.

4 Conclusions

The wish to work independently expresses itself not only in the evaluated figures, but also in the strong participation in the group discussions and the questionnaire. Our students want us to enable them to work independently. "Today's students, young or old, are leaning towards participatory education and are no longer satisfied to be passive recipients of knowledge" (Erskine 1998, p. 7). We realize this, for example by giving them an approximate timing of lessons to help structure their learning activities according to their needs (see Hill 1997, p.76). We support customization of learning material by integrating common features, e.g. bookmarks, comments, highlighting pen etc. and extending them with a tool still in development called SmartBars. It will enable students to show or hide footmarks, diverse highlighting functions, hints to further going literature, notes from the author, notes from the learner etc. (see Reiners 2002). Intuitive navigation within Vorms will be made possible by offering navigation through hyperbolic trees (see Reiners 2002). The development team of Vorms is convinced that hyperbolic trees are very intuitive to use. What students think about this is going to be evaluated in the future. The implementation depends on the results of this evaluation.
We support the student's wish to work flexibly by giving the synchronization between lecture and VLE a high priority. This way we "...can empower students so learn in new ways and to develop higher-order cognitive skills" (Falk 1995, p. 9).
Our students want to influence the difficulty level of exercises and questions and the way problems and exercises are explained. On the one hand, our students want to learn actively in a constructivist way (see Entwistle 1991, p. 340). On the other hand however, they seem to want programmed instruction (see Criswell 1989, p. 4) because they want the program to make decisions for them, for example giving them a question which has the adequate difficulty level, or telling them in which content areas they still have weaknesses. We are going to continue research in this area, to try to identify the factors that create these different preferences.
The ongoing development of Vorms focuses on those functions, that were evaluated to be of importance to the students. We will transfer the student priorities into the priorities of development. As shown in the questionnaire, there are several differences in the preferences between men and women. The development of Vorms is also going to keeping track of these gender differences.

"In looking at this new learning environment, it is important to remember that the technology does not *cause* the change. Instead, it is probably better to say that the capabilities of the new technologies allow us to facilitate change" (Miller 1996, p. 42). We feel that it is important to integrate those persons into the development process, who are supposed to profit from the new technology. For this reason, we will keep our students integrated in the formative evaluation of the learning environment Vorms.

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